TRANSPLANTING INCREASES INTRA- AND INTER-SPECIFIC BEAN SURVIVORSHIP IN FIELD PLANTINGS. Neil O. Anderson and Peter D. Ascher, Dept. of Horticultural Science, Univ. of Minnesota, St. Paul, MN 55108

Introduction. Field trials are important in *Phaseolus* research programs for determining yield, seed increases, selection of new phenotypes in the target environment(s), drought stress, disease resistance, etc. Maximizing germination and survivorship of valuable genetic material in field plantings ensures survival of critical genotypes, providing adequate population sizes for statistical analyses. Since growing seasons are short in temperate regions, cool soil temperatures and/or excess rainfall may significantly reduce germination of direct-sown seeds during the spring planting period. Replanting accessions with little or no germination has been a suitable alternative. However, such replantings may be too late into the growing season to reach maturity. During the 1992 and 1993 growing seasons, the continuation of cool and wet weather meant that, in some instances, replanted seeds would also fail to germinate. For instance, in 1992, our plantings of indeterminate *P. acutifolius*, *P. coccineus*, and *P. vulgaris* intra- and inter-specific hybrids had 0% germination. Since 1993 promised similar growing conditions to those experienced in 1992, an alternative solution to replanting direct-sown seeds was investigated: the use of mechanical transplanting for field establishment.

Materials and Methods. **Genotypes.** Intra- (n=209) and inter-specific (n=409) accessions, for a total of N=1460 and N=2490 seeds, of *P. acutifolius*, *P. coccineus*, *P. lunatus*, and *P. vulgaris* were included in the 1993 field plantings. Interspecific hybrids included two- and four-way intraspecific hybrids; two-, four-, eight-, and twelve-way intraspecific hybrids were parents in interspecific hybridizations. Interspecific hybrids included two- (*P. vulgaris x P. coccineus*, *P. vulgaris x P. acutifolius*, *P. lunatus x P. polystachys*, and reciprocals) and three-species ({*P. vulgaris x P. acutifolius*} x *P. coccineus*) populations. Parents were included for measuring the effects of hybrid breakdown (caused by incongruity) and heterosis. Intra- and inter-specific populations were derived from either recurrent (RBC) or congruity (CBC) backcrossing. These were planted for field evaluation, on an individual basis, of germination type, growth habit, flower bud initiation and development, color (flower, pod, leaves, stems) stigma position, pod stringiness, drought stress tolerance, yield, and hybrid breakdown.

Transplantation Experiment. *Phaseolus* accessions were planted in replicated (n=6 or n=12) trials. Prior to planting, the seedcoats of all genotypes were scarified by nicking (scratching) with a sharp razor blade. Seeds were sown May 28-30, 1993, in premolded sphagnum moss peat pots filled with Baccto Professional Planting Mix (Michigan Peat Co., Houston, TX). Germination occurred under greenhouse conditions (45° N lat.) with 18°/22° C (day/night) and long day photoperiods (0600-2200 HRS), using high intensity discharge sodium vapor (400 watt) lamps for supplemental lighting. On June 11-15, emerged seedlings were transplanted into the St. Paul campus fields. A one-person Holland Transplanter (Holland Transplanter Co., Holland, MI) was used to transplant the seedlings 1.5' O.C. within rows that were spaced 2' apart and oriented in a serpentine fashion. Number of surviving individuals was recorded one month after transplanting. Due to a rainy June and July, preemergent herbicides failed to maintain weed-free field conditions. The field was planted with *Brassica* seeds, developed for use as living mulches, which either prevent germination of or out-competed most weeds.

Results and Discussion. Since germination was less than 100% for most accessions, only germinated seedlings were transplanted into the field. Mechanical transplantation allowed for rapid planting of the bean seedlings. In several pedigrees the seedlings exceeded the maximum height accommodated by the planter. These seedlings were planted at an angle by the planting arms or, in some cases, were injured. Within two weeks after transplanting, seedlings had become established; root growth penetrated through the peat pots into the field soil. Plant growth 4-6 weeks after transplanting was equivalent to that of direct-sown plants rated the previous year. Throughout the summer, ratings were performed for the traits of interest. Production of snap beans in several indeterminate, three-species CBC hybrids exceeded that for conventional intraspecific cultivars due to different inflorescence structures.

Survivorship of intraspecific accessions ranged from 81% to 100% (Table 1). Few accessions exhibited severe transplantation shock. Rapid recovery of transplants was surprising since seedlings were not acclimated. Interspecific transplants displayed a wider range in transplantation recovery and survivorship (54.8 - 100%) (Table 1). Lower survivorship in these complex CBC hybrids is attributable to hybrid breakdown which arises when parents used in wide crosses are incongruous.

Despite this, sufficient population sizes were attained to assess phenotypic segregations. In comparison with 1992 germination and survivorship of seedlings (direct-sown), where no indeterminate genotypes germinated, mechanical transplantation significantly circumvented unusually cool and inclement summer weather experienced during 1993. Use of mechanical transplanters successfully eliminates germination in cool, wet field soils. Additionally, the growing season can be extended by planting two week old seedlings at the time that direct-sown seeds would normally be planted.

Table 1. Seedling survivorship of pure line, intra- or inter-specific hybrid transplants.

Species and Accessions	No. of Accessions	No. of Plants	No. of Survivors	Percent Survivorship
P. acutifolius				
Cultivars	6	72	65	90.3
USDA Accessions	3	18	15	83.3
POOLED	9	90	80	88.9
P. coccineus				
Cultivars	2	3	3	100.0
2- and 4-way Intraspecific Hybrids	6	11	9	81.8
POOLED	8	14	12	85.7
P. lunatus				
Cultivars	1	12	10	83.3
P. vulgaris				
High Protein Accessions	9	108	96	88.9
Cultivars	18	216	176	81.5
Mutation Series	25	180	158	87.8
2- and 4-way Intraspecific Hybrids	18	108	100	92.6
USDA Accessions	1	12	11	91.7
Wild CIAT Accessions	8	48	39	81.2
1992 Crosses	112	672	609	90.6
POOLED	191	1344	1189	88.5
SPECIES POOLED	209	1460	1291	88.4
P. lunatus x P. polystachys	7	42	23	54.8
P. vulgaris x P. acutifolius				
8-way *P. acutifolius* parents	9	24	23	95.8
CBC Series	76	514	450	87.5
CBC Series x High Protein Lines	125	750	620	82.7
1991 CBC Crosses	16	96	64	66.7
1992 CBC Crosses	1	6	6	100.0
POOLED	227	1390	1163	83.7
P. vulgaris x P. coccineus				
USDA Accessions (Lamprecht)	56	336	294	87.5
Marikis Alvarez Accessions	11	66	57	86.4
1992 Crosses (Honduran)	8	48	42	87.5
POOLED	75	450	393	87.3
(P. vulgaris x P. acutifolius) x P. coccineus				
Margaret Hibberd's M15-M38	2	12	12	100.0
M38 x TARS 387	2	24	24	100.0
Heidi Mickelsen's CBC	56	336	282	83.9
1992 Crosses	33	194	155	79.9
1992 Crosses (Honduran)	7	42	34	80.9
POOLED	100	608	507	83.4
INTERSPECIFIC POOLED	409	2490	2086	83.8